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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/704,498	11/06/2003	Justin K. Brask	42P17821	3238

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Michael A. Bernadicou
BLAKELY, SOKOLOFF, TAYLOR & ZAFMAN LLP
Seventh Floor
12400 Wilshire Boulevard
Los Angeles, CA 90025

EXAMINER

CHEN, KIN CHAN

ART UNIT	PAPER NUMBER
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1765

DATE MAILED: 02/14/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 10/704,498	Applicant(s) BRASK ET AL.	
	Examiner Kin-Chan Chen	Art Unit 1765	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 1-12-2006.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 6-30 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 16-20 is/are allowed.
- 6) ☒ Claim(s) 6-15 and 21-30 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|-----------------------------------------------------------------------------------------|-----------------------------------------------------------------------------|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on January 12, 2006 has been entered.

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

3. Claims 21-24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Verhaverbeke (US 5,972,123) or David et al. (US 6,015,505) as evidenced by Adetutu et al. (US 6,902,969), Gilmer et al. (US 2004/0191974), and Ilardi et al. (US 5,466,389).

In a method for wet etching a metal layer, Verhaverbeke (col. 3, lines 25-28; col. 4, lines 21-24, 51-54; **col. 5, lines 30-32**) or David et al. (abstract; col. 6) teaches that a metal layer (including a metal recited in instant claim 23) may be formed on a substrate. The metal layer has a thickness. The metal layer may be exposed to a wet etch chemistry such as a chelating agent (e.g., EDTA, see also Ilardi (US 5,466,389; col. 4,

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lines 8-11, a typical chelating agent). Verhaverbeke or David is not particular about the thickness of metal being etched. Hence, it would have been obvious to one with ordinary skill in the art to use the desired thickness depending on the particular product requirement, and it is common in the art of semiconductor device fabrication that thin metal layer may be less than about 50 angstroms, see Adetutu et al. (US 6,902,969) or Gilmer et al. (US 2004/0191974) as evidence. Since same chelating agent (e.g., EDTA) is used as an active ingredient in the wet etchant, it is expected that the diameter of the active ingredient exceed the thickness of the metal layer.

Because the prior art teaches forming a masking layer on the metal layer and applying wet etching chemistry including chelating agent, and because the purpose of using the masking layer is, obvious to one skilled in the art, to mask the metal layer underneath so as not to be etched, therefore, the removal of the metal layer underneath the mask layer is blocked by the masking layer.

4. Claims 6-15 and 25-30 are rejected under 35 U.S.C. 103(a) as being unpatentable over Verhaverbeke (US 5,972,123) or David et al. (US 6,015,505) in view of Adetutu et al. (US 6,902,969), Gilmer et al. (US 2004/0191974), and Ilardi (US 5,466,389).

In a method for wet etching a metal layer, Verhaverbeke (col. 3, lines 25-28; col. 4, lines 21-24, 51-54; col. 5, lines 30-32) or David et al. (abstract; col. 6) teaches that a metal layer (including a metal recited in instant claim 23) may be formed on a substrate. The metal layer has a thickness. The metal layer may be exposed to a wet etch chemistry such as a chelating agent (e.g., EDTA; see also Ilardi (US 5,466,389; col. 4, lines 8-11, a typical chelating agent).

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Verhaverbeke or David is not particular about the thickness of metal being etched. Hence, it would have been obvious to one with ordinary skill in the art to use the desired thickness depending on the particular product requirement, and it is common in the art of semiconductor device fabrication that thin metal layer may be less than about 50 angstroms, see Adetutu et al. (US 6,902,969) or Gilmer et al. (US 2004/0191974) as evidence. Since same chelating agent is used as an active ingredient in the wet etchant, it is expected that the diameter of the active ingredient exceed the thickness of the metal layer.

Verhaverbeke (col. 4, lines 51-54) or David (abstract, col. 8, lines 23-27) is not limited to any particular structure of semiconductor device being etched, but teaches using wet etching method for integrate circuits. Hence, it would have been obvious to one with ordinary skilled in the art to etch the structures commonly used in the semiconductor device fabrication. In a method for making a semiconductor device, Adetutu (col. 2; col. 3, lines 33-35; col. 5, lines 61-65; Figures) or Gilmer ([0005] [0008] [0023] [0025] [0028]; Figures) teaches a high-k gate dielectric layer may be formed on a substrate. A metal layer may be formed thereon. The first metal layer may be less than about 50 angstroms. The first portion of the first metal layer may be removed. A second metal layer may be formed on the high-k gate dielectric, the first portion of the second metal layer covering the remaining portion of the first metal layer and a second portion of the second metal layer covering the high-k gate dielectric layer. The second metal layer may be less than about 100 angstroms thick (or 50 angstroms). A masking layer may be formed; the metal may be wet etched. Hence, it would have been obvious to one with ordinary skill in the art to use the wet etch method and etchant to etch the

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structure of Adetutu or Gilmer because it is a well-known structure in the art of semiconductor device fabrication and because it is disclosed by Adetutu or Gilmer. As to the materials for the metal layer, Adetutu (col. 5, lines 61-65) teaches various materials may be used for p-channel gate or n-channel gate, hence, it would have been obvious to one with ordinary skill in the art to use any common p-type metals and n-type metals, and Gilmer ([0008]) discloses various common p-type metals and n-type metals for CMOS.

Because the combined prior art teaches forming a masking layer on the metal layer and applying wet etching chemistry including chelating agent, and because the purpose of using the masking layer is, obvious to one skilled in the art, to mask the metal layer underneath so as not to be etched, therefore, the removal of the metal layer underneath the mask layer is blocked by the masking layer.

The claimed invention differs from the prior art by specifying well-known features (such as using polysilicon as mask in claims 9 and 11) to the art of semiconductor device fabrication (the examiner takes official notice) and using various concentrations of the ingredient of etchant (e.g., moles/liter of a chelating agent). However, same is known to be result effective variable and commonly determined by routine experiment. The process of conducting routine experimentations (optimizations) so as to produce an expected result is obvious to one of ordinary skill in the art. In the absence of showing criticality or unexpected results, a person having ordinary skill in the art would have found it obvious to modify prior art by performing routine experiments (by using various concentrations) to obtain optimal result and adding same well-known

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feature to same in order to provide effective masking with a reasonable expectation of success. It is noted that applicant did not traverse the aforementioned conventionality (e.g., well-known features, common knowledge, obviousness), which have been stated in the previous office action (August 3, 2005).

The above-cited claims (e.g., claims 13 and 14) differ from the prior art by specifying work functions (e.g., 3.9 eV- 4.2eV; 4.9eV –5.2eV) of the metal layer. However, since n-type metal and p-type metal may be used in the prior art, same work functions (e.g., 3.9 eV- 4.2eV; 4.9eV –5.2eV) of the metal layer would be expected.

- The above-cited claims (e.g., claim 25) differ from the prior art by specifying the diameter of the active ingredient exceed the thickness of the metal layer thereby preventing the active ingredient from significantly undercutting the metal layer underneath the masking layer. However, because the same materials (e.g., chelating agents) are used with the same process, it is expected that the method of the combined prior art would contain the same properties and functions as claimed.

When the examiner has reason to believe that functional language asserted to be critical for establishing novelty in claimed subject matter may, in fact be an inherent characteristic of the prior art as discussed above, the burden of proof is shifted to the applicant to prove that the subject matter shown in the prior art does not possess the characteristics relied upon. Whether the rejection is based on "inherency" under 35 U.S.C. §102, or on "prima facie obviousness" under 35 U.S.C. §103, jointly or alternatively. In re Fitzgerald et al. 205 USPQ 594.

Response to Arguments

5. Applicant's arguments filed January 12, 2006 have been fully considered but they are not persuasive.

Applicant has argued that the prior art does not teach the removal of the metal layer underneath the mask layer is blocked by the masking layer. It is not persuasive. As has been stated in the office action, because the prior art teaches forming a masking layer on the metal layer and applying wet etching chemistry including chelating agent, and because the purpose of using the masking layer is, obvious to one skilled in the art, to mask the metal layer underneath so as not to be etched, therefore, the removal of the metal layer underneath the mask layer is blocked by the masking layer.

Applicant has argued that the prior art does not teach that the diameter of the active ingredient exceeds the thickness of the metal layer thereby the undercut of the metal layer under a masking layer is mitigated, inhibiting a significant isotropic undercut etch. It is not persuasive. As has been stated in the office action, it is common in the art of semiconductor device fabrication that thin metal layer may be less than about 50 angstroms, see Adetutu et al. (US 6,902,969) or Gilmer et al. (US 2004/0191974) as evidence. Since **same chelating agent (e.g., EDTA)** is used as an active ingredient in the wet etchant, it is expected that the diameter of the active ingredient exceed the thickness of the metal layer. As such, the same materials are used with the same process, it is expected that the method of the combined prior art would contain the same properties and functions as claimed. Also see the case law cited above.

Applicant has argued that EDTA is not an active etching ingredient in David. It is not persuasive. Since same material (EDTA) is used to etch same metal layer, the same etching characteristics would have been expected.

When the examiner has reason to believe that functional language asserted to be critical for establishing novelty in claimed subject matter may, in fact be an inherent characteristic of the prior art as discussed above, the burden of proof is shifted to the applicant to prove that the

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subject matter shown in the prior art does not possess the characteristics relied upon. Whether the rejection is based on "inherency" under 35 U.S.C. §102, or on "prima facie obviousness" under 35 U.S.C. §103, jointly or alternatively. In re Fitzgerald et al. 205 USPQ 594.

Applicant has argued that Adetutu et al. or Gilmer et al. does not teach the diameter of the active ingredient exceed the thickness of the metal layer. It is not persuasive.

One cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. In re Merk & Co., Inc., 800F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986).

Allowable Subject Matter

6. Claims 16-20 allowed.

Conclusion

7. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Ilardi (US 5,466,389; col. 4, lines 8-11) discloses some common chelating agents including EDTA.

8. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Kin-Chan Chen whose telephone number is (571) 272-1461. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nadine Norton can be reached on (571) 272-1465. The fax phone number

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for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

February 9, 2006



Kin-Chan Chen
Primary Examiner
Art Unit 1765